

REMARKS

A request for a one-month extension of time (an extension to August 30, 2001) to respond to the Office Action dated April 30, 2001, together with the required fee, accompany this amendment. Claims 1 to 16 have been canceled and new claims 17 to 40 have been added to the application. The fee required for increasing the number of claims to 24 accompanies this amendment.

With reference to paragraphs 1 and 2 of the Office Action, Appendix A contains a proposed new Figure 4 that illustrates the three-dimensional fabric structure of the aramid fiber composite substrate with associated stitching or fiber axes along or about the z-axis of the fabric as well as the z-axis of the fabric. In addition, a reference to the new Figure 4 has been proposed for inclusion in the specification under the "BRIEF DESCRIPTION OF THE DRAWING".

With reference to paragraph 3 of the Office Action, wherein the specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. The specification has been amended to provide the proper antecedent basis for the claimed subject matter.

With reference to paragraph 4 of the Office Action, claim 15 has been canceled.

With reference to paragraph 5 of the Office Action, claims 1-14 and 16 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 1 to 16 have been canceled and new claims 17 to 40 have been submitted with this amendment. The objections to claims 1 to 14 and 16, were noted in the drafting of new claims 17 to 40 and the new claims are believed to comply with 35 U.S. C. 112. With respect to the objection to the bullet descriptions "M193", "M855", "SS109", "M80", "LPS", and/or "PS", these bullet designations are bullet designations of the United States Army that are utilized to more specifically identify particular 5.56mm and 7.62mm bullets. Appendix B is a United States Army specification showing these designations.

With reference to paragraphs 6 to 12 of the Office Action, it is noted that paragraph 12 indicated that claims 12-14 and 16 would be allowable if rewritten to overcome the rejection(s) under 35 U.S. C. 112, second paragraph, set forth in the Office Action and to include all of the limitations of the base claim and any intervening claims. Claim 17 is claim 12 rewritten in independent form to include the limitations of

claim 1 and overcome the rejection based on 35 U.S.C. 112. Claims 18 to 24 depend from claim 17. Claim 25 is claim 13 rewritten in independent form to include the limitations of claim 1 and overcome the rejection based on 35 U.S.C. 112. Claims 25 to 32 depend from claim 25. Claim 33 is claim 14 rewritten in independent form to include the limitations of claim 1 and overcome the rejections based on 35 U.S.C. 112. Claims 34 to 40 depend from claim 33. In view of the amendments to the specification, drawings and claims, the subject patent application should be in condition for allowance and the allowance of the subject patent application is requested.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

Page 2 of the specification, amend the first paragraph after the heading "SUMMARY OF THE INVENTION", as follows:

The ceramic armor apparatus of the present invention described and claimed herein comprises a [Boron Carbide] ceramic facing element bonded to an [Aramid] aramid fiber composite substrate. The ceramic armor apparatus of the present invention provides protection against a 5.56mm M193 bullet, a 5.56mm M855 bullet, a 5.56mm SS109 bullet, a 7.62mm M80 bullet, a 7.62mm LPS bullet, and a 7.62mm PS bullet either alone or in any combination thereof. The ceramic facing element may consist of a plurality of elements, such as tiles, or may be a singular ceramic plate that is either flat or molded to the desired shape. The aramid fiber composite substrate is comprised of a plurality of layers of aramid fibers arranged in either fabric or unidirectional tape structures. The aramid fiber composite substrate layers are stacked to achieve the desired thickness and protection, and are laminated using a variety of polymer compounds to create a singular element. The aramid fiber composite substrate is arranged to be [be] generally parallel to the ceramic facing element such that the shape of the aramid fiber composite substrate mirrors that of the ceramic facing element.

Page 4 of the specification, amend the two paragraphs beginning on the eleventh line of the text, as follows:

Within the ceramic armor elements 11 [is] are the singular or monolithic ceramic tile or facing element 12, the adhesive layer element 13, and the aramid fiber composite substrate element 14. The combined thickness of the ceramic facing element 12, the adhesive layer element 13, and the aramid fiber composite substrate element 14 falls in the range between 0.430-inches and 0.530-inches inclusively. The combined weights of the ceramic facing element 12, the adhesive layer element 13, and the aramid fiber composite substrate element 14 falls in the range between 4.00- and 5.70-pounds-per-square-foot inclusively. The ceramic [tile] facing element 12 may be made of any appropriate non-oxide ceramic material, for example, Boron Carbide, Silicon Carbide

ceramics. Alternatively, a ceramic matrix composite or metal matrix composite containing Silicon Carbide or Boron Carbide particles may be used. Although ceramic thickness may be varied to suit a specific need, the preferred ceramic arrangement ranges from 0.080-inches to [0.269] 0.310-inches in thickness.

Disposed against and roughly parallel to back of the ceramic facing element 12 is the adhesive layer element 13 that forms a discreet layer.

Page 5 of the specification, amend the five paragraphs beginning on fourth line of text, as follows:

Disposed against the back of the adhesive layer 13, and roughly parallel to the back of the ceramic facing element 12, is aramid fiber composite substrate element or plate 14.

The aramid fiber composite substrate plate 14 may be made of any appropriate aramid fiber, such as Kevlar® or Twaron® fiber having a fineness ranging from 250- to 3,500-denier. Aramid fiber constructions such as fabrics, unidirectional tapes, felts, non-woven layers, or three-dimensional structures may be used. For example, aramid fiber fabrics in plain, basket, or twill weave styles with basis weights between 3.5- and 20.0-ounces-per-square-yard may be used; aramid fiber unidirectional tapes with all tapes arranged in 0, 15, 30, 45, 60, 90-degree orientation or combinations thereof may be used; or three dimensional structures that incorporate stitching or fiber axes along or about the z-axis of the fabric may be used. The aramid fiber composite substrate layer 14 is arranged to create a uniform structure that ranges from 0.130-inches to 0.350-inches thickness.

The aramid fibers of the aramid fiber composite substrate plate 14 are encased in a polymer matrix to form a rigid laminate. Virtually any appropriate polymer resin may be used for the matrix, for example Phenolic, Phenolic Polyvinyl Butyral rubber blends, Polyester, Vinylester, polyurethane, and polyolefin resins. For convenience, the aramid fiber composite substrate plates illustrated in the drawing Figures are cross hatches as metal.

When the aramid fiber composite substrate plate 14 employs a polymer resin matrix, the preferred resin content ranges from fifteen to twenty-four percent by weight.

An alternate embodiment 20 of the present invention is illustrated in Fig. 3. Figure 3 comprises a perspective view, partially broken away and in partial section, of apparatus 20 of the present invention where the ceramic armor [tile layer] assembly 19 comprises a plurality of individual ceramic tile elements [tiles] as exemplified by elements 17 and 18, the adhesive layer 13, and the aramid fiber composite substrate 14. The ceramic tile facing elements 17 and 18 can be square ceramic tiles or otherwise shaped to suit the dimensional needs of a particular application.